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(11)

EP 1 217 640 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.06.2002 Bulletin 2002/26

(51) Int Cl.7: **H01H 21/26, H01H 3/14**

(21) Application number: 01129842.9

(22) Date of filing: 14.12.2001

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

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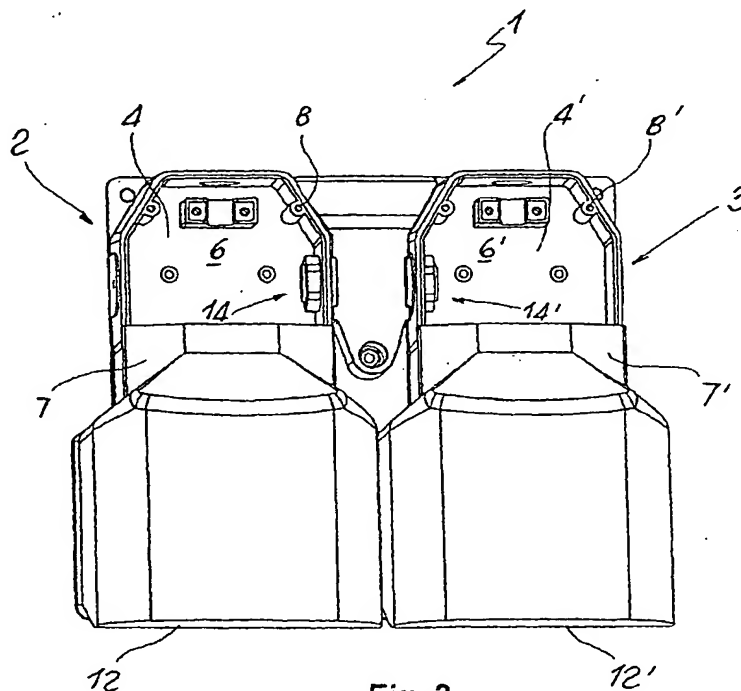
(30) Priority: 22.12.2000 IT VI000289

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(54) Pedal-operated multiple switch

(57) Pedal-operated multiple switch comprising two or more separate box-shaped bodies (2, 3) provided with respective compartments (4, 4') for housing electrical contacts (5, 5'), pedal operating means (50, 50') mechanically associated with each box-shaped body (2, 3) and operationally acting on said electrical contacts (5, 5') so as to select the activated state thereof and one or more joining pieces (13) which can each be mechani-

cally fastened in a removable manner by means of fixing means (14) to two box-shaped bodies (2, 3) so as to form a single unit therewith. According to the invention, the joining piece (13) is also provided with a duct (15) for allowing means for electrical connection of said contacts (5, 5') to pass through, said duct having terminal openings (16, 16') aligned with corresponding holes (18, 18') formed on the box-shaped bodies (2, 3).

**Fig. 2****EP 1 217 640 A2**

Description

Field of the invention

[0001] The present invention relates to a pedal-operated multiple switch comprising all the characteristics features listed in the preamble of the main claim.

[0002] More precisely the invention is intended to be used advantageously in the field of pedal-operated switches, in particular of the type used in the industrial sector in order to operate machines which require the use of both hands by the operators controlling them.

Background art

[0003] Known machines include wood-working machines or pipe-bending machines where both the operator's hands are occupied with supporting or positioning the workpiece. These machines are usually provided with one or more pedal switches which are connected by means of an electrical cable to the machine and can be positioned in the most convenient manner for performing the operation in question.

[0004] From an operational point of view, the machines of the type indicated above generally require the use of several pedals in order to perform all the operations associated with functioning thereof. Therefore, for example, a start pedal, stop pedal and a pedal for each specific processing operation which the machine must perform may be envisaged. In order to facilitate the displacement and electrical wiring thereof, the individual pedals are joined together as a single unit.

[0005] For some specific operations it is possible to envisage the use of a carrying bar rigidly connected to the set of switches so as to allow easy movement thereof by the operator.

[0006] Moreover, to ensure the operator's safety, a pushbutton, generally of the mushroom type, for emergency stoppage of the machine may be also be provided, said pushbutton being mounted on the carrying bar or on the cover of the switch.

[0007] At present, as is known, in the sector of pedal switches there is a particularly pressing need to combine the individual switches in a single unit, ensuring the protection thereof and the isolation of the electrical parts from the external environment, in particular from possible water infiltration.

[0008] In this situation, essentially two different solutions for pedal switches, which solve in a different manner the problem of connecting together in a single unit several switches which can be used separately, at present form part of the state of the art.

[0009] Therefore, as is known, a first switch solution, for example described and claimed in industrial patent US 4,354,071, envisages the use of a single box-shaped body from which several operating levers emerge. In this case, any carrying bar is arranged above the switch and preferably on the cover of the box-

shaped body. The box-shaped body houses internally both the electrical circuit connected to the machine controlled by the switch and the mechanical actuators which can be operated by the operator's feet via the individual levers. Since, as explained previously, the number of pedals required may vary depending on the type of machine for which the multiple switch is intended and/or depending on functioning of the machine itself, with this solution it is necessary to produce box-shaped bodies in several sizes depending on the number of operating levers which are to be used to satisfy the specific requirements. Consequently, in accordance with this known constructional solution, the manufacturers of pedal-type multiple switches must use a considerable number of moulds in order to satisfy the various requirements of the industry at present and cover the needs of all the specific applications.

[0010] It should be remembered, moreover, that in this situation it is required to keep a large quantity of finished products in stock in order to be able to satisfy promptly the requests for switches by customers, which may relate precisely to switches provided with a different number of operating levers.

[0011] This results in high warehouse management costs, in addition, obviously, to large spaces required in order to store all the different types of switches.

[0012] Generally, therefore, the circumstances referred to above, associated with the abovementioned first constructional solution of a pedal switch, have a negative effect on the costs of production thereof.

[0013] A second known multiple switch solution envisages the use of individual pedal switches which are connected together mechanically by means of metal joining plates. The electrical connection between the individual switches is ensured by electrical cables passing through suitable side holes formed in the sides of the box-shaped bodies of the said individual switches.

[0014] The same cables are sealed by means of suitable insulating sheaths and sheath-support or cable-pressing elements which are intended to ensure the sealed connection with the box-shaped bodies of the switches.

[0015] It is known that in this constructional solution, the metal joining plates are connected to carrying bars, if present, for example by means of screwing or welding.

[0016] The safety switches are in turn traditionally mounted on the ends of these carrying bars and envisage the use of additional electrical connections protected by special sheaths for connection with the circuitry of the switches.

[0017] In practice, this second embodiment of a multiple switch has revealed numerous drawbacks.

[0018] A first drawback arises directly from the difficulties which are encountered in sealing the box-shaped bodies of the individual pedal switches, the electrical contacts of which are electrically connected together by means of small lateral ducts which are formed with insulating sheaths and inside which electrical cables

pass.

[0019] Moreover, in the case where the use of one or more safety pushbuttons is envisaged, it will be required to connect them up electrically to the individual pedal switches, for example by means of a connection to be performed using the cables which are inserted in turn inside the box-shaped bodies via suitable holes, which may be contained in the side ducts. In practice, however, this solution does not offer a sufficient guarantee as to water tightness and therefore is not intrinsically entirely reliable.

[0020] A second drawback which greatly penalises this embodiment consists in the fact of having to produce differently formed plates depending on the number of pedal switches which are to be assembled. Once again this fact negatively influences the productive efficiency of these multiple switches, resulting in an increase in the production costs and warehouse management costs.

Summary of the invention

[0021] The main object of the present invention is therefore that of eliminating the abovementioned drawbacks by providing a pedal-operated multiple switch which is perfectly isolated from the external environment and in particular has a high degree of liquid tightness and may at the same time be easily adapted so as to function within certain limits with any number of pedal operating levers.

[0022] Another object is that of providing a pedal-type multiple switch on which a carrying bar may be selectively mounted.

[0023] Another object is that of providing a pedal-type multiple switch on which a safety switch may be selectively mounted.

[0024] Yet another object of the invention is that of providing a pedal-type multiple switch which is simple to produce and allows a reduction in the quantity of warehouse stocks.

[0025] A further object of the invention is that of providing a pedal switch comprising several modules which can be joined together so as to form the desired number of pedal operations.

[0026] A further object of the invention is that of providing a pedal-type multiple switch in which each individual pedal switch is connected mechanically and electrically to the adjacent switches by means of a single joining element which is simple and easy to install.

[0027] Finally, a further object of the invention in question is that of providing a pedal-type multiple switch which is operationally simple and functionally entirely reliable.

[0028] These and other objects are achieved by the pedal-type multiple switch in question, which comprises at least two or more separate box-shaped bodies with respective compartments containing electrical contacts and pedal operating means mechanically associated

with each box-shaped body and operationally acting on the electrical contacts so as to select the activated state thereof, characterized in that it comprises at least one joining piece which can be removably fastened to said box-shaped bodies so as to form a single unit, said joining piece being provided with at least one duct for allowing means for electrical connection of said contacts to pass through, said duct having terminal openings which can be coupled with corresponding holes formed in the box-shaped bodies.

[0029] As a result of this arrangement, it is possible to limit significantly the production costs by limiting the number of components necessary for satisfying each request for pedal switches by customers.

Brief description of the drawings

[0030] Further characteristic features and advantages of the invention may be immediately understood in the light of the detailed description which follows of a preferred, but not exclusive embodiment of a pedal-operated switch according to the invention, provided by way of a non-limiting example with the aid of the accompanying plates of drawings in which:

FIG. 1 shows a general perspective view, in exploded form, of a first embodiment of a pedal-operated multiple switch according to the invention, with some parts sectioned or removed so that other parts may be seen more clearly;

FIG. 2 shows a general perspective view of the switch according to Fig. 1 in assembled form with some parts sectioned or removed so that other parts may be seen more clearly;

FIG. 3 shows a general perspective bottom view of the switch according to Fig. 1;

FIG. 4 shows a general perspective view, in exploded form, of the switch according to Fig. 1 with some parts removed so that other parts may be seen more clearly;

FIG. 5 shows a general perspective view of a second example of embodiment of a pedal-operated multiple switch according to the invention, provided with a carrying bar and with some parts sectioned or removed so that other parts may be seen more clearly;

FIG. 6 shows a general perspective view of a third example of embodiment of a pedal-operated multiple switch according to the invention, provided with a bar comprising a safety pushbutton and with some parts sectioned or removed so that other parts may be seen more clearly;

FIG. 7 shows a schematic, partially sectioned side view of the switch according to Fig. 6.

Detailed description of a preferred example of embodiment

[0031] With reference to the said figures, 1 denotes in its entirety a multiple switch according to the present invention.

[0032] Below reference will be made, for the sake of simplicity of the description, to a multiple switch composed of two single switches, it being understood, however, that the multiple switch in question may consist, as will be clarified below, of any number of switches, without thereby departing from the scope of protection of the present patent.

[0033] The switch 1 comprises essentially two separate and identical box-shaped bodies 2 and 3 with respective compartments 4, 4' for housing electrical contacts 5, 5'.

[0034] In greater detail, each box-shaped body 2, 3 is formed by a base 6, 6' which is closed at the top by means of a cover 7, 7' fixed by means of screws - not shown - engaged in female threads 8, 8' formed in the said base 6, 6'.

[0035] The box-shaped body 2, 3 of each individual switch therefore has a front part 9, 9' in which the base 6, 6' defines, together with a side wall 10, 10', the housing compartment 4, 4', and a rear part 11, 11' with pedal-operated means 50, 50' arranged so as to actuate operationally the electrical contacts 5, 5' and select the activated state thereof.

[0036] Operationally, each individual switch functions owing to the action of a foot which, inserted inside a pocket 12, 12' formed in the rear part 11 of the box-shaped 2, 3, operates a corresponding lever which, by means of transmission and driving means, controls the activation state of the corresponding electrical contacts 5, 5' arranged in the front part 9, 9' of the said box-shaped body 2, 3.

[0037] This front body 9, 9' is, for this purpose, perfectly isolated from external agents and in particular is perfectly impervious to water or other liquids.

[0038] The operating lever and the driving means which allow the electrical contacts to be activated by means of the feet have not been shown in detail in the accompanying figures since they are already known and therefore easily within the grasp of any person skilled in the art.

[0039] According to the invention, the multiple switch 1 also comprises a joining piece 13 which can be fastened in a removable manner via suitable fixing means 14, 14' to both the box-shaped bodies 2, 3 so as to form a single unit (see Fig. 2). The same joining piece 13 is also provided with a through-duct 15 with terminal apertures 16, 16' which can be sealingly coupled with corresponding through-holes 18, 18' formed in the box-shaped bodies of the two separate switches. In so doing, the two box-shaped bodies 2, 3, which are per se sealed with respect to external agents, are linked together by means of the through-duct 15 which is also watertight.

[0040] Suitable electrical connection means 19 may therefore be inserted, entirely safely, inside this through-duct 15 so as to connect electrically the electrical contacts 5, 5' of the individual switches.

5 These connection means 19 may simply consist of electrical cables.

[0041] In accordance with a preferred embodiment of the present invention, the joining piece 13 is located, in the assembled configuration of the multiple switch 1 illustrated in Fig. 2, between the box-shaped bodies 2 and 3 of the two individual switches, and is provided with side walls 20, 20' having a shape substantially complementing or matching the side surfaces 21, 21' of the two box-shaped bodies 2, 3.

10 [0042] The contact between the joining piece 13 and the two box-shaped bodies takes place along suitable annular surfaces 22, 22' formed on the fixing means 14, 14'.

[0043] In the example shown in the accompanying figures, the joining piece 13 has a form which is substantially symmetrical with respect to a longitudinal centre plane. Moreover, the two box-shaped bodies 2, 3 between which the piece 13 is located are externally entirely identical. Consequently, the side walls 20, 20' of the joining piece 13 extend necessarily parallel to the side surfaces 21, 21' of the two switches, opposite which they must be arranged.

[0044] Should it be required to use a multiple switch 1 composed of three or more separate switches with corresponding operating means, this may be obtained by simply arranging in series the desired number of individual switches and mechanically and electrically connecting the respective box-shaped bodies thereof by means of several joining pieces 13 of the type illustrated above. Obviously, the switches at the ends of the sequence will be provided with a single through-hole while those in an intermediate position will be provided with two through-holes.

40 [0045] More particularly, the through-duct 15 is provided with end lugs or portions 23, 23' which can be inserted into the holes 18, 18' and can be fastened in this position via the fixing means 14, 14'. The latter may consist of first screwing means essentially composed of one or more nuts 24, 24' which can be engaged with matching threads 25, 25' formed on the end portions 23, 23' of the duct 15.

45 [0046] The water-tightness, if necessary, may be obtained by means of seals 26, 26' mounted coaxially on the end portions 23, 23' and arranged between the annular surfaces 22, 22' of the joining piece 13 and the side surfaces 21, 21' of the two box-shaped bodies 2 and 3.

50 [0047] Advantageously, in order to provide the single unit of the multiple switch 1 in question with a greater mechanical strength, each box-shaped body 2, 3 is provided, at the respective base 6, 6', with one or more connecting lugs 28, 28' intended for connection with the joining piece 13 via second screwing means. The latter

may envisage, for example, one or more screws 29, 29' which can be screwed into holes 30, 30' formed in the connecting lugs 28, 28' so as to engage with corresponding female threads (not shown) formed on the joining piece 13.

[0048] In accordance with a further characteristic feature of the multiple switch 1 illustrated in Fig. 5, a carrying bar 31 is rigidly fixed to the joining piece 13. For this purpose, the joining piece 13 is provided with a cylindrical seat 32 inside which a corresponding end of the carrying bar 31 may engage, said end in turn being fastened by means of a screw, not shown in the drawings, through a hole 32'. Obviously, the said carrying bar 31 may be fixed to the joining piece by means of any further connecting member, such as a weld or a thread for example.

[0049] Figs. 6 and 7 illustrate the possibility of mounting, on the multiple switch 1, a plant engineering component 33 which is electrically connected to the electrical contacts 5, 5' of the individual switches.

[0050] For this purpose, the joining piece 13 is provided, in a constructional variant, with an internally hollow projecting lug 34 communicating with the through-duct 15 and provided with an upper opening 35 intended to be mechanically coupled in a sealed manner with the plant engineering component 33 or with a branched connection thereof.

[0051] The plant engineering component 33, for example consisting of a safety switch with a mushroom-type activating pushbutton 36, may be electrically connected to one or more electrical contacts 5, 5' of the individual switches by means of electrical connections 52 passing inside the projecting lug 34 and the through-duct 15. Alternatively, the plant engineering component 33 may be directly connected to the electrical system of machine in which the switch is installed, located outside the box-shaped bodies 2, 3.

[0052] In the example shown in Figs. 6 and 7, the safety switch 33 is arranged inside a rigid casing 37 fixed to an internally hollow, substantially rod-shaped, branched portion 38 with a threaded end section, engaging, by means of screwing, inside a thread formed inside the projecting lug 34. Obviously, in this case also, numerous other connecting systems may be provided, if necessary in a sealed manner, between the projecting lug and the plant engineering component 33, said systems all remaining within the scope of the same inventive idea.

[0053] The material which forms each box-shaped body 2, 3 as well as the joining piece 13 will be preferably plastic and in particular may be, for example, glass-fibre reinforced PA, self-extinguishing ABS or other technically equivalent materials.

[0054] The pedal-type multiple switch according to the invention may be subject to numerous modifications and variations, all remaining within the inventive idea defined in the accompanying claims.

[0055] All the details may be replaced by other equivalent

details without departing from the scope of the invention.

5 Claims

1. Pedal-operated multiple switch comprising:

- at least two separate box-shaped bodies (2, 3) with respective compartments (4, 4') for housing electrical contacts (5, 5');
- pedal operating means (50, 50') mechanically associated with each box-shaped body (2, 3) and operationally acting on said electrical contacts (5, 5') so as to select the activated state thereof;

characterized in that it comprises at least one joining piece (13) which can be removably fastened to said box-shaped bodies (2, 3) so as to form a single unit, said joining piece (13) being provided with at least one duct (15) for allowing means (19) for electrical connection of said contacts (5, 5') to pass through, said duct having terminal openings (16, 16') which can be coupled with corresponding holes (18, 18') formed in said box-shaped bodies (2, 3).

2. Multiple switch according to Claim 1, **characterized in that** said joining piece (13) can be arranged between said two separate box-shaped bodies (2, 3) and is provided with side walls (20, 20') having a shape substantially matching the side surfaces (21, 21') of said box-shaped bodies (2, 3) and provided with substantially annular contact surfaces (22, 22').

3. Multiple switch according to Claim 1, **characterized in that** said through-duct is provided with end portions (23, 23') which can be inserted in said holes (18, 18').

4. Multiple switch according to Claim 3, **characterized in that** said end portions (23, 23') are fixed in said through-holes (18, 18') by means of suitable fixing means (14, 14').

5. Multiple switch according to Claim 4, **characterized in that** it envisages fixing means (14) which are able to connect mechanically said joining piece (13) to said box-shaped bodies (2, 3) and are provided with screwing means (24, 24') acting on said end portions (23, 23') so as to mount rigidly said through-duct (15) between the holes of said box-shaped bodies (2, 3).

6. Multiple switch according to Claim 5, **characterized in that** said first screwing means (24, 24') are substantially composed of one or more nuts which can

- be engaged on corresponding threads (25, 25') formed on said end portions (23, 23').
7. Multiple switch according to Claims 2 and 3, **characterized in that** it envisages seals (26, 26') mounted coaxially on said end portions (23, 23') between said annular contact surfaces (22, 22') of the joining piece (13) and said side surfaces (21, 21') of the box-shaped bodies (2, 3).
 8. Multiple switch according to Claim 1, **characterized in that** each said box-shaped body (2, 3) is provided with a connecting lug (28, 28') intended for rigid connection with the joining piece (13) via fixing means (14).
 9. Multiple switch according to Claim 8, **characterized in that** said fixing means (14) envisage second screwing means interacting with said connecting lugs (28, 28') and said joining piece (13) so as to connect them together rigidly.
 10. Multiple switch according to Claim 9, **characterized in that** said screwing means envisage one or more screws (29, 29') which can be inserted with engagement inside holes (30, 30') formed in said connecting lugs (28, 28') and engaging in corresponding holes formed in said joining piece (13).
 11. Multiple switch according to Claim 1, **characterized in that** it comprises at least one carrying bar (31) rigidly fixed to said joining piece (13).
 12. Multiple switch according to Claim 11, **characterized in that** said joining piece (13) is provided with at least one seat (32) inside which a corresponding end portion of said carrying bar (31) may be engaged.
 13. Multiple switch according to Claim 1, **characterized in that** said joining piece (13) is provided with at least one internally hollow projecting lug (34) communicating with said through-duct (15) and provided with an upper opening (35) intended for mechanical connection, if necessary in a sealed manner, with a plant engineering component (33).
 14. Multiple switch according to Claim 1, **characterized in that** said plant engineering component (33) can be electrically connected to one or more of said electrical contacts (5, 5') or to the electrical safety circuit of the machine by means of electrical connections (51) passing inside said projecting lug (34) and said through-duct (15).
 15. Multiple switch according to Claim 13, **characterized in that** said plant engineering component (33) consists of at least one safety switch.
 16. Multiple switch according to Claim 15, **characterized in that** said safety switch is provided with an activating pushbutton (36) and is arranged inside a rigid casing (37) with an internally hollow, substantially rod-shaped branched portion (38) having a threaded end section engaging by means of screwing inside a matching thread formed in said projecting lug (34).
 17. Multiple switch according to Claim 1, **characterized in that** each said box-shaped body (2, 3) is substantially composed of a base (6, 6') and a cover (7, 7') which can be fixed together by means of screws.

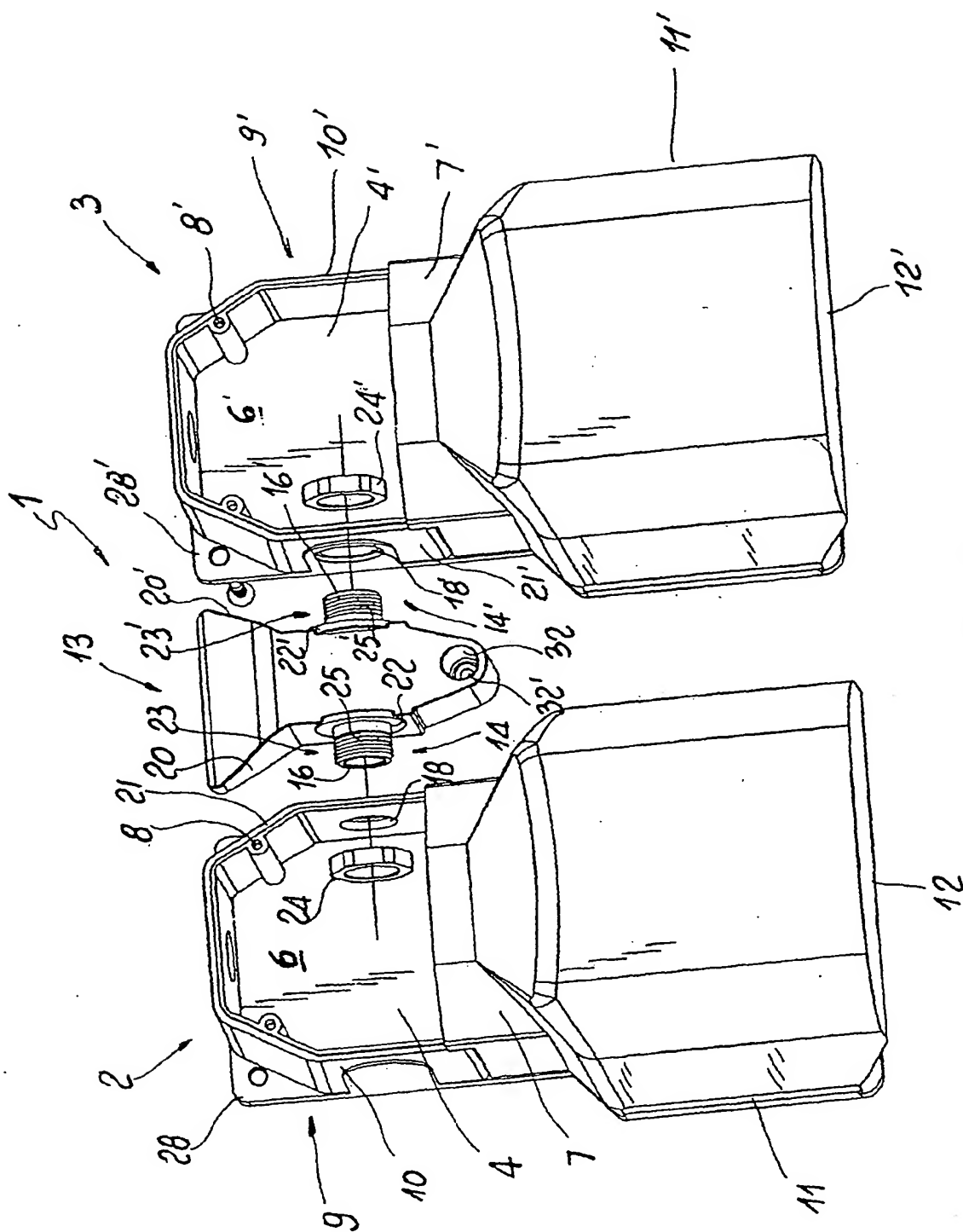


Fig. 1

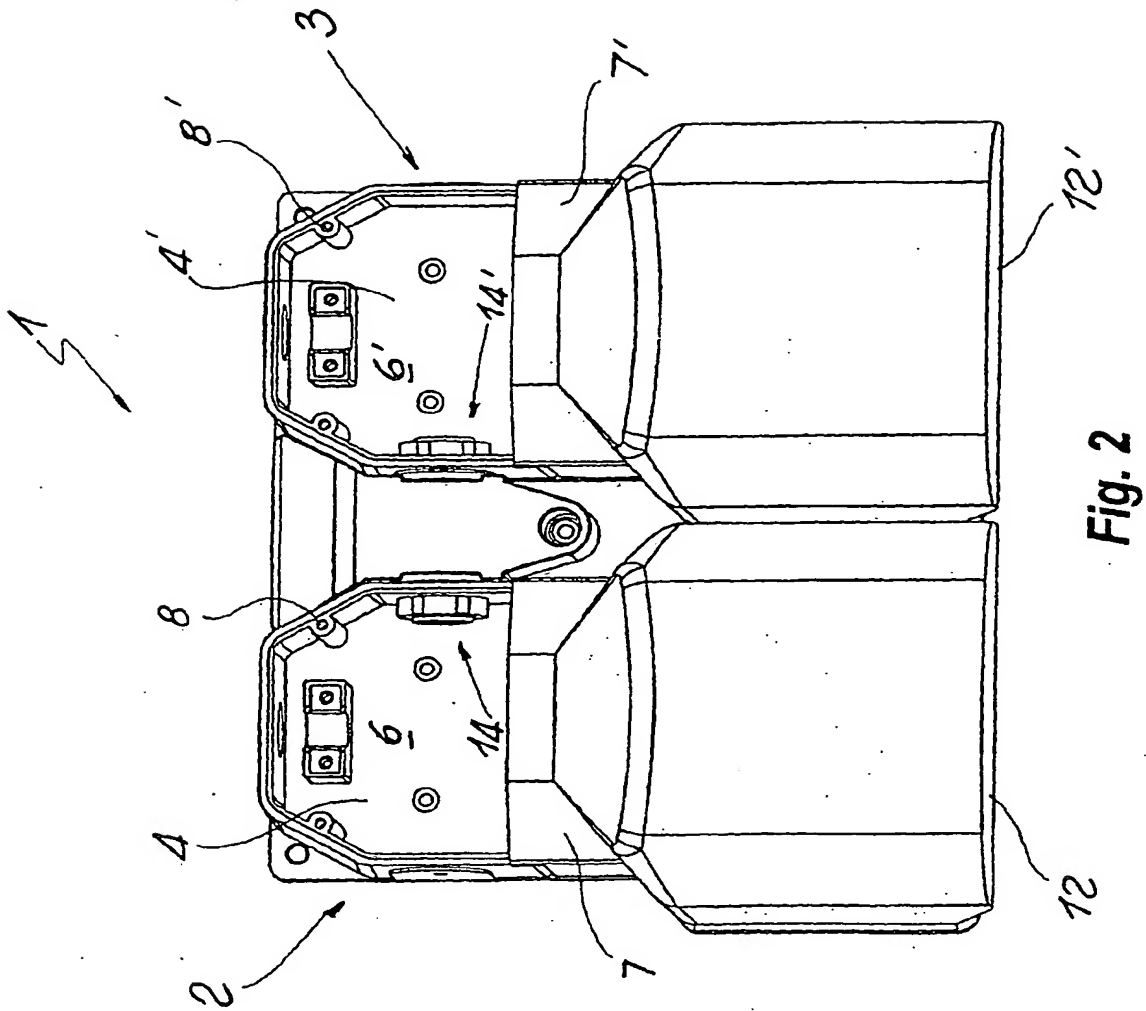


Fig. 2

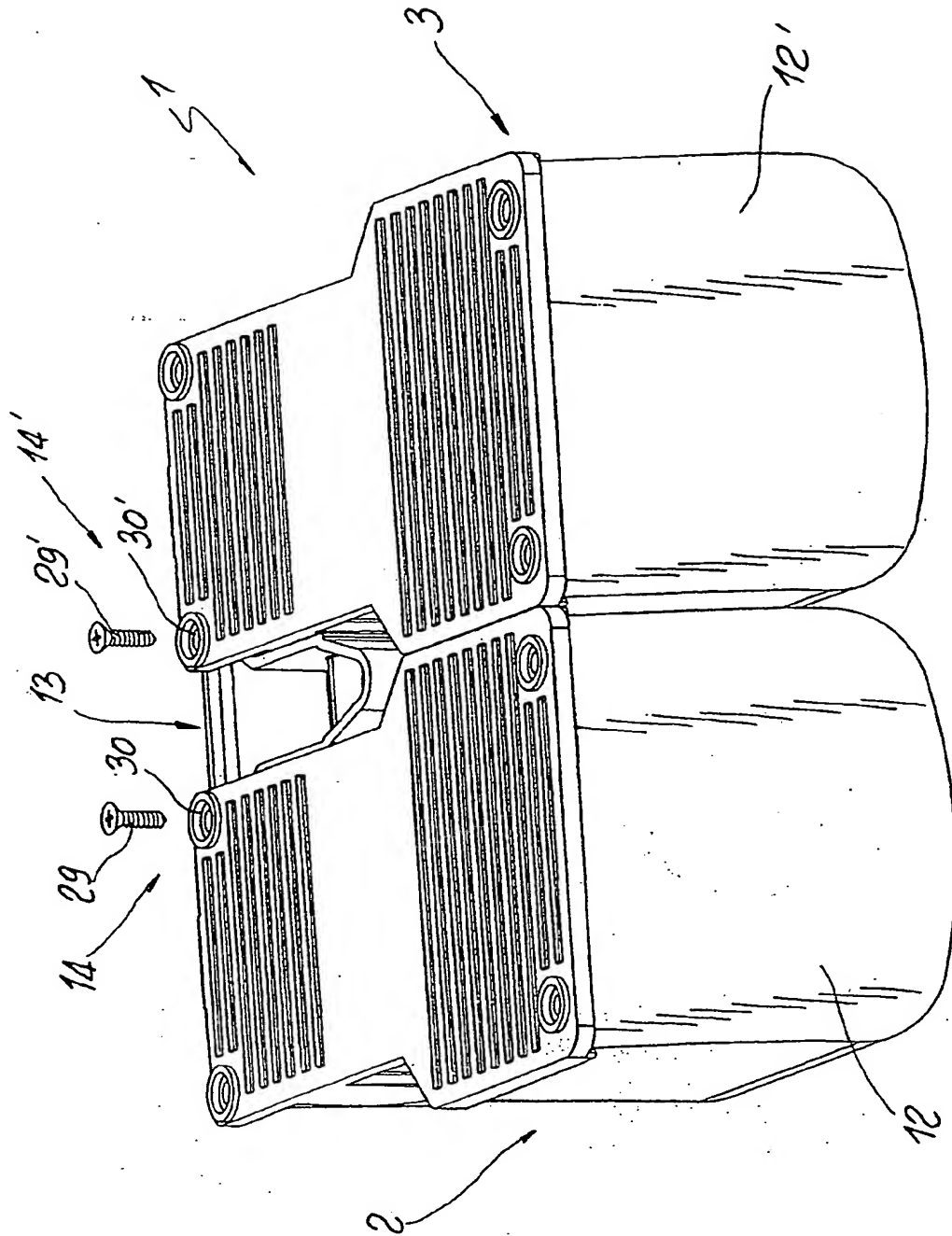


Fig. 3

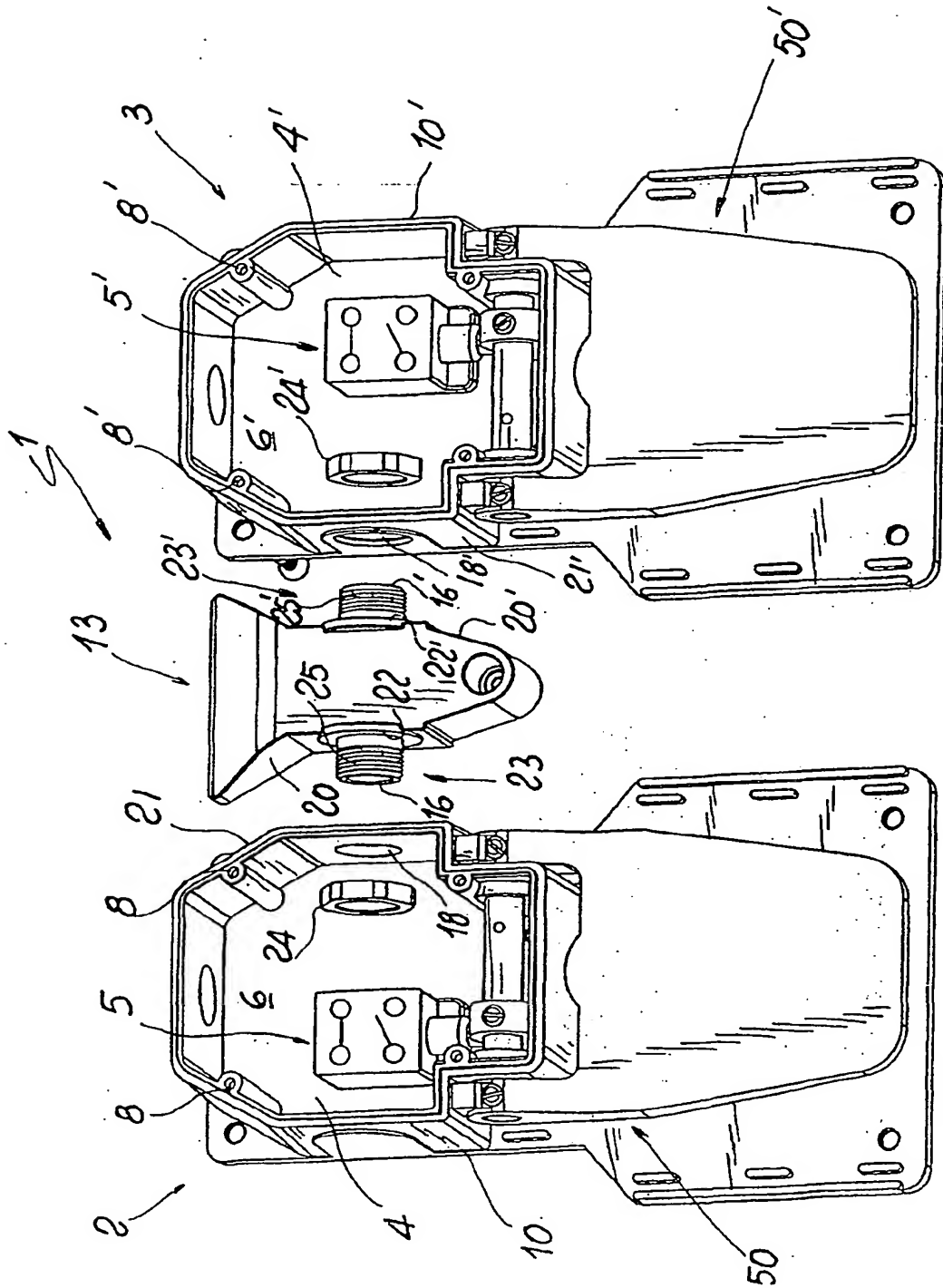


Fig. 4

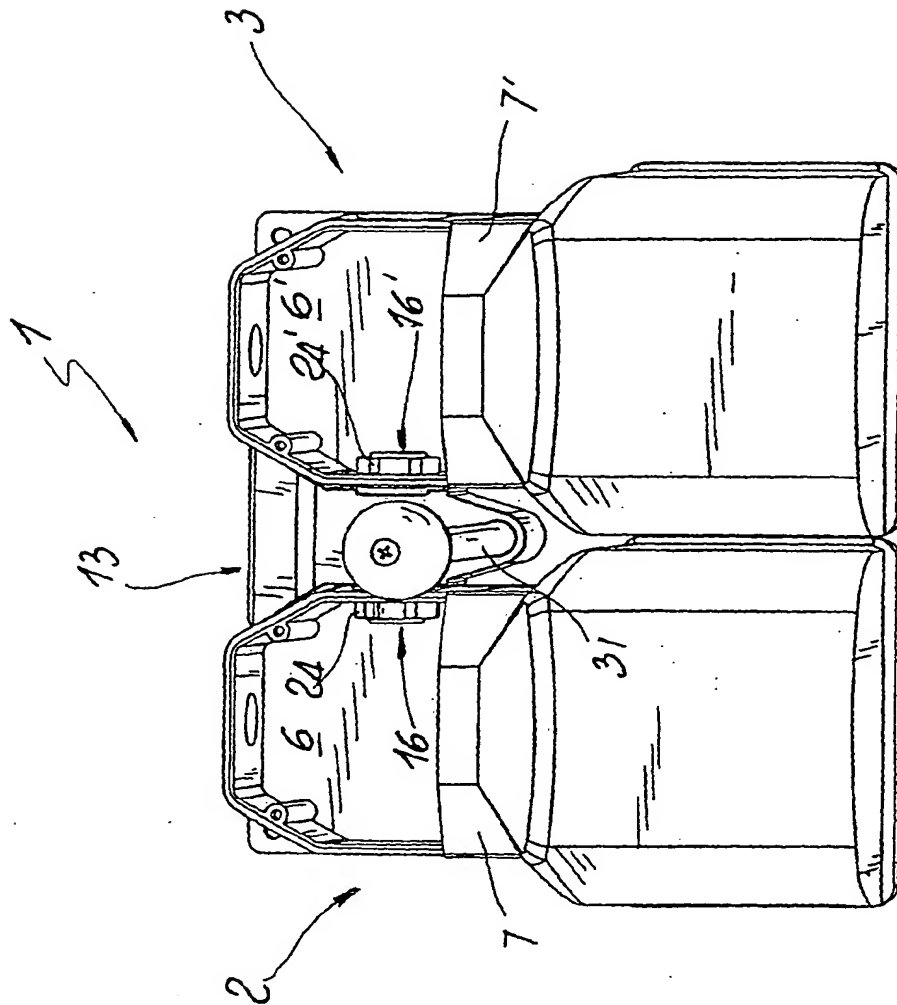


Fig. 5

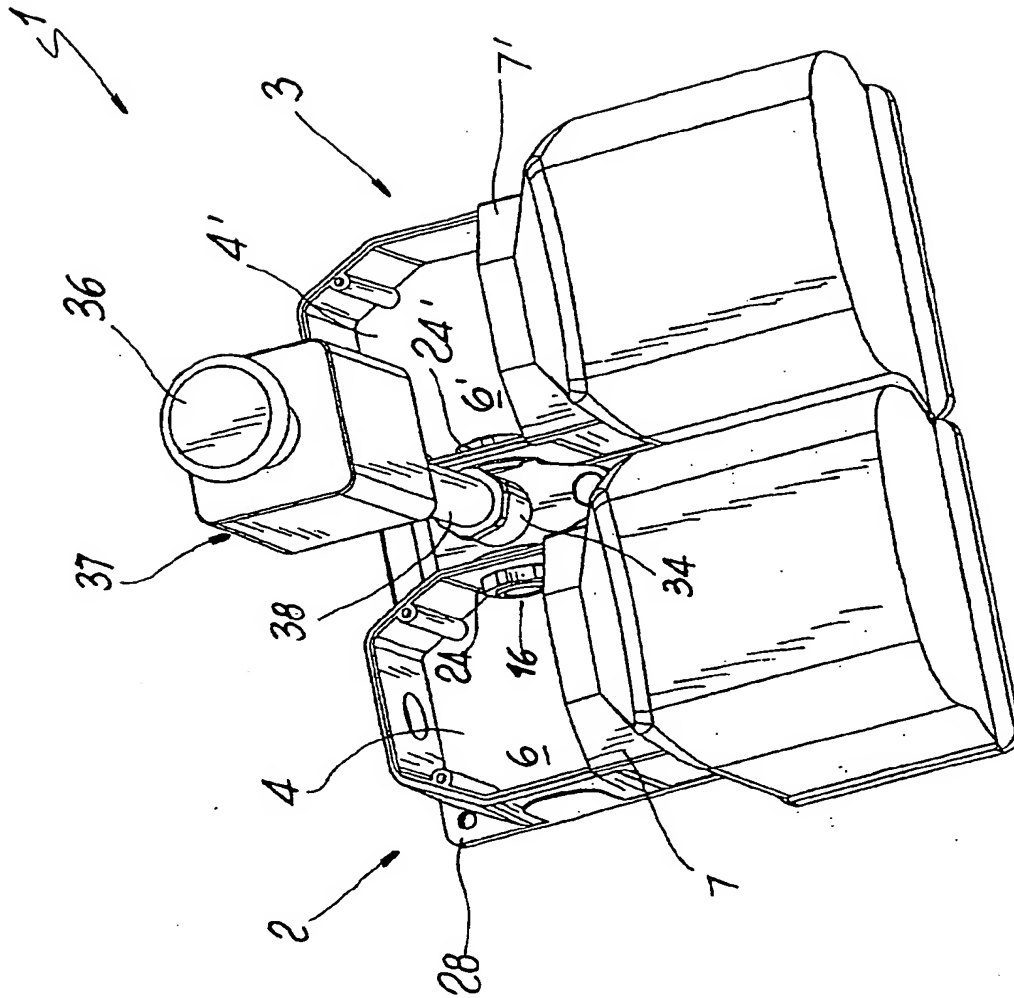


Fig. 6

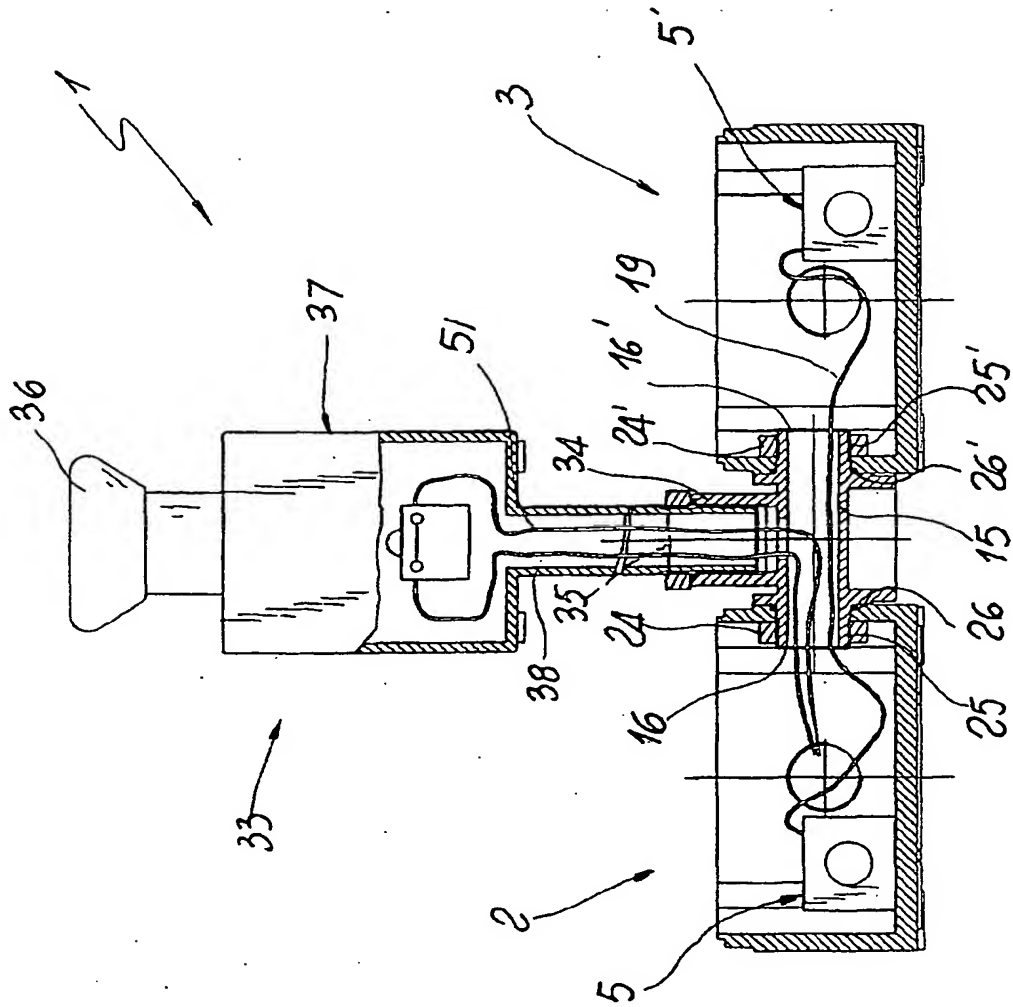


Fig. 7